216XA/217XA-7401 LSI DIGITAL IC REPLACEMENT PARTS KIT P/N 829937 INSTALLATION INSTRUCTION SHEET

ITEM NO.	REF. DESIGN	DESCRIPTION	P/N	QUANTITY
1.	—	Instruction Sheet	829945	1
2.*	U4	IC, LSI Digital P-MOS	803452	1
3.*	2160-4022	UUT Adapter	830125	1

*These two items are precalibrated as a unit (P/N 834150)

AFFECTED MODEL NUMBERS: 2160A, 2165A, 2166A, 2168A, 2170A, 2175A, 2176A

AFFECTED S/N: 4342000 and below.

BACKGROUND

This kit contains the necessary parts and instructions to replace the obsoleted part U4, LSI Digital IC, part number 403527.

REWORK INSTRUCTIONS

Replacement of U4 for instruments S/N 4342000 and below will require the following rework.

1. For component locations refer to the main PCB reference designator drawing located in Section 8 of the Thermometer Instruction Manual.
2. Desolder and remove the components listed in Table 1 of this instruction sheet from the main PCB of the unit.

Table 1

Model #	Remove These Components From the Main PCB
2160A, 2170A	R1,* C2, VR2
2165A, 2166A 2168A, 2175A 2176A	R1,* C2, VR3

*C2 may be located on the bottom of the PCA.

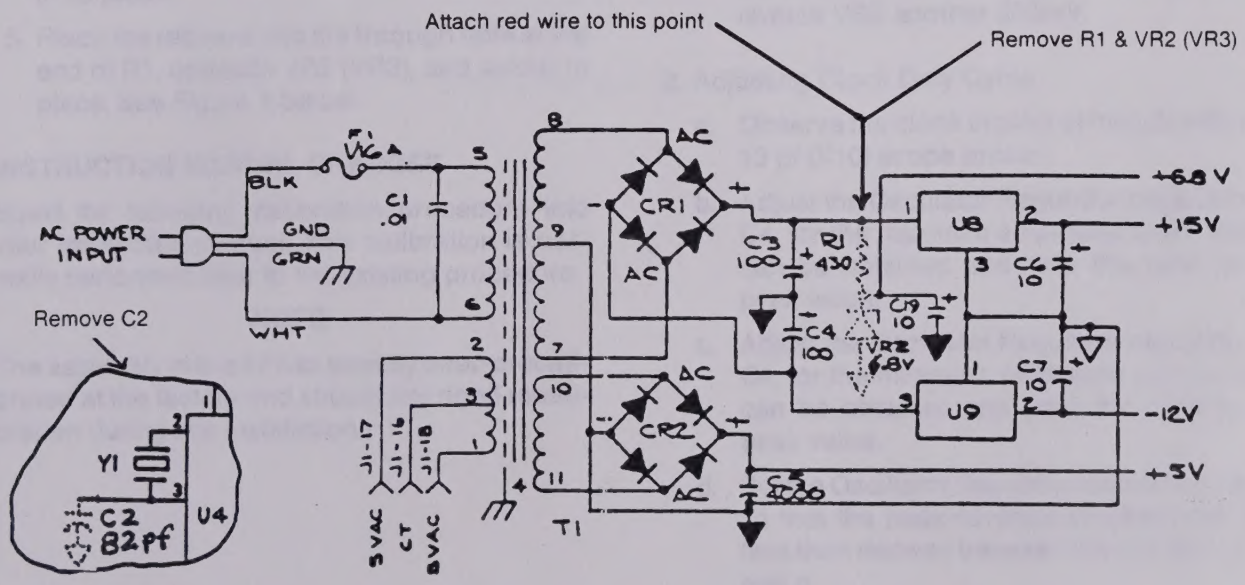


Figure 1.

Litho in U.S.A.

NOTE: Step 3 is applicable to the 2166A, 2165A, 2175A & 2176A only.

3. The length of the Type Select PCS is such that it may interfere with installation of the oscillator regulator assembly. To eliminate this interference remove the PCA and trim off approximately 1/8" from the end marked Front. See Figure 2.

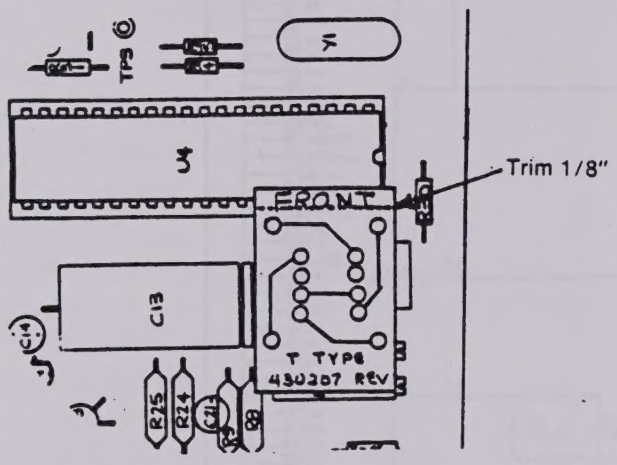


Figure 2.

4. Remove the LSI (U4) from its socket and install the new LSI and oscillator regulator assembly in its place.
5. Place the red wire into the through hole at the end of R1, opposite VR2 (VR3), and solder in place. See Figure 1 below.

INSTRUCTION MANUAL CHANGES

Insert the following calibration procedure into your instruction manual. This calibration is normally performed prior to the existing procedure.

NOTE

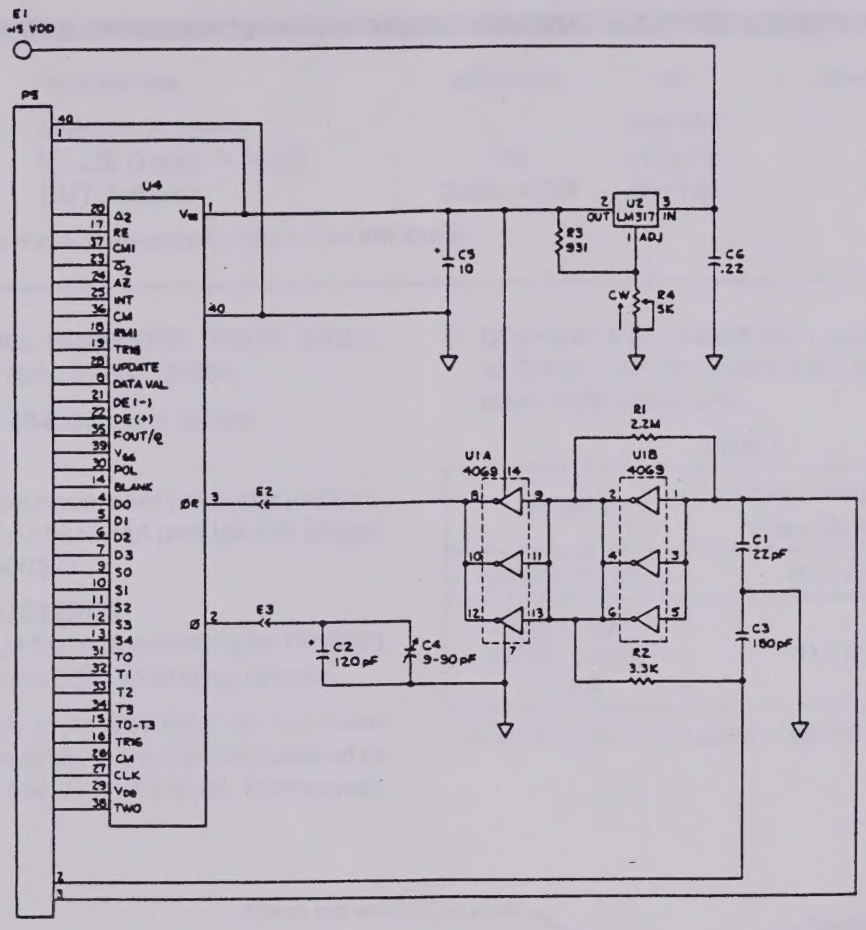
The assembly in this kit has already been precalibrated at the factory and should not need recalibration during this installation.

OSCILLATOR REGULATOR CALIBRATION PROCEDURE

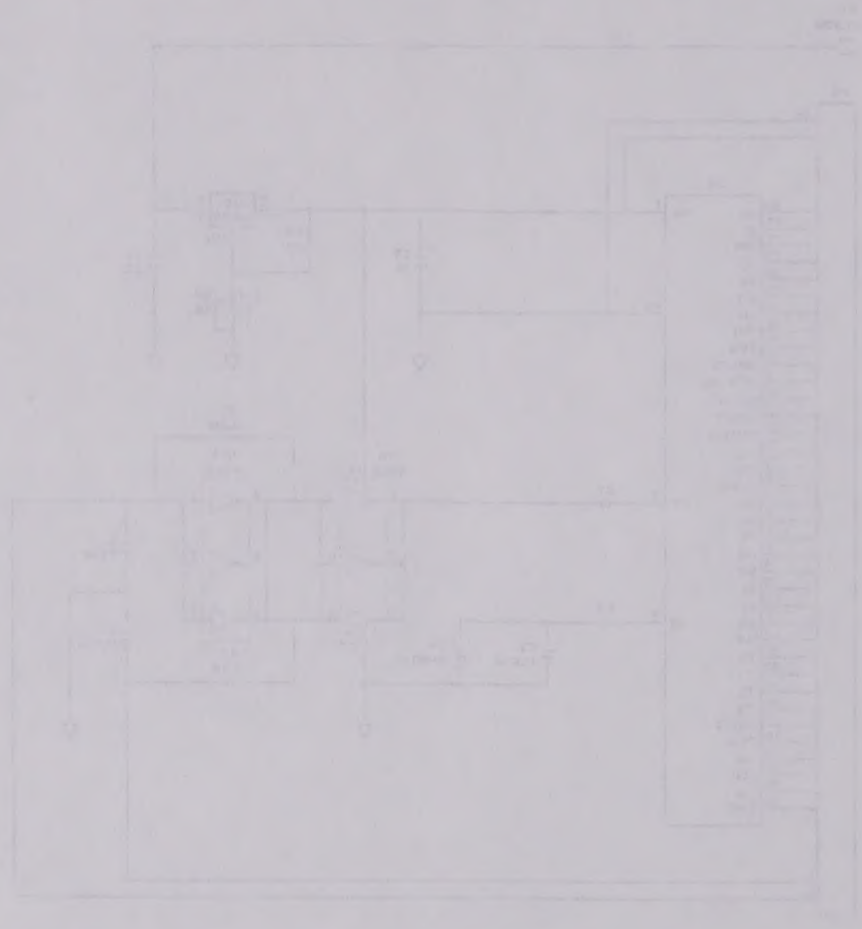
1. Adjusting VSS
   a. Put the instrument in Fahrenheit mode.
   b. Using an oscilloscope observe the Strobe 0 signal on pin 9 of the LSI with respect to digital common.
   c. Using a DMM, measure between digital common and pin 1 of the LSI. Adjust VSS, R4 on the oscillator regulator, for maximum (around 8 volts). If the Strobe 0 pulse width in Step B is not 320 microseconds and stable then decrease VSS until the Strobe 0 pulse width in Step B is 320 microseconds and stable.
   d. Observing the DMM reading, continue to reduce VSS to 200mV below the point reached in Step C, ie., if VSS in Step C is 7.65 volts, reduce to 7.45 volts.
   e. With the thermocouple circuit open, check for proper operation of the display in Celcius mode (flashing -200 for 2160, 2165, 2166, 2168 and flashing -99.9 for 2170, 2175 and 2176).
   f. If the display is not proper, continue to decrease VSS (R4) until the display indication is correct as described in Step E, then reduce VSS another 200mV.

2. Adjusting Clock Duty Cycle
   a. Observe the clock at pin 2 of the LSI with a 13 pf (X10) scope probe.
   b. Adjust the Oscillator Regulator capacitor, C4, for the maximim amplitude clock that can be obtained and note the peak-to-peak value.
   c. Adjust the Oscillator Regulator capacitor, C4, for the minimum amplitude clock that can be obtained and note the peak-to-peak value.
   d. Set the Oscillator Regulator capacitor, C4, so that the peak-to-peak amplitude is .2 less than midway between the values in b. and c.

Add the following schematic of the LSI Assembly to your Instruction Manual.



Oscillator Regulator 2160A-1022



FLUKE

216XA/217XA-7401 LSI DIGITAL IC REPLACEMENT PARTS KIT P/N 829937 INSTALLATION INSTRUCTION SHEET

ITEM NO.	DESCRIPTION	REF. DESIG.	P/N	QUANTITY
1.	Instruction Sheet		829945	1
2.*	IC, LSI Digital P-MOS	U4	803452	1
3.*	UUT Adapter	2160-4022	830125	1

**These two items are precalibrated as a unit (P/N 834150)*

AFFECTED MODEL NUMBERS: 2160A, 2165A, 2166A, 2168A, 2170A, 2175A, 2176A.

AFFECTED S/N: 4342000 and below.

BACKGROUND

This kit contains the necessary parts and instructions to replace the obsoleted part U4, LSI Digital IC, part number 403527.

REWORK INSTRUCTIONS

Replacement of U4 for instruments S/N 4342000 and below will require the following rework.

1. For component locations refer to the main PCB reference designator drawing located in Section 8 of the Thermometer Instruction Manual.
2. Desolder and remove the components listed in Table 1 of this instruction sheet from the main PCB of the unit.

Table 1

Model #	Remove These Components From the Main PCB
2160A, 2170A	R1,* C2, VR2
2165A, 2166 2168A, 2175A 2176A	R1,* C2, VR3

**C2 may be located on the bottom of the PCA.*

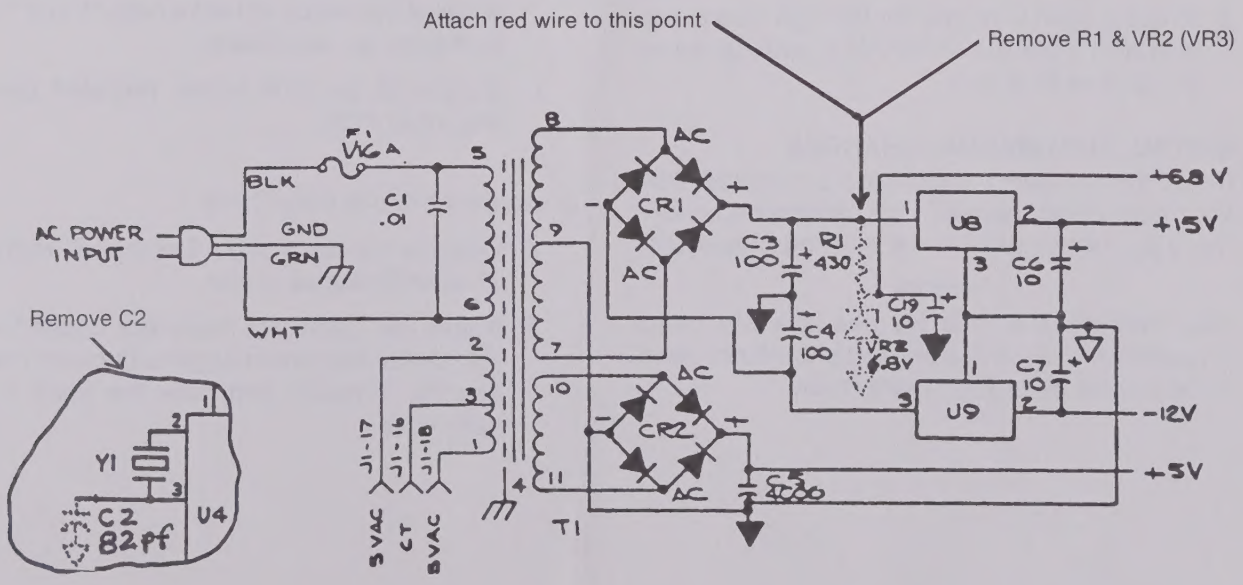


Figure 1.

Litho in U.S.A.

NOTE: Step 3 is applicable to the 2166A, 2165A, 2175A and 2176A only.

3. The length of the Type Select PCB is such that it may interfere with installation of the oscillator regulator assembly. To eliminate this interference remove the PCA and trim off approximately 1/8" from the end marked Front. See Figure 2.

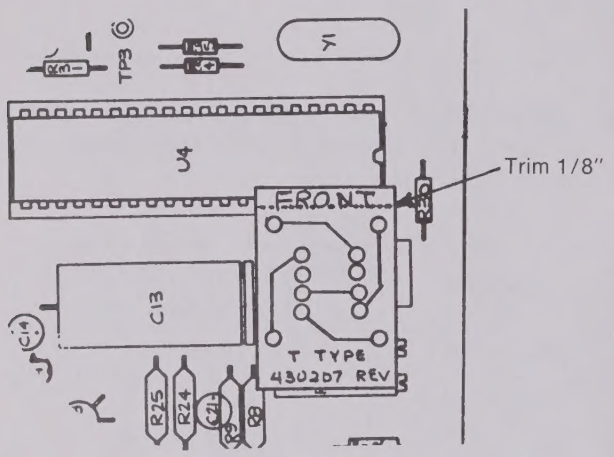


Figure 2.

4. Remove the LSI (U4) from its socket and install the new LSI and oscillator regulator assembly in its place.
5. Place the red wire into the through hole at the end of R1, opposite VR2 (VR3), and solder in place. See Figure 1.

INSTRUCTION MANUAL CHANGES

Insert the following calibration procedure into your instruction manual. This calibration is normally performed prior to the existing procedure.

NOTE

The assembly in this kit has already been precalibrated at the factory and should not need recalibration during this installation.

216XA OSCILLATOR REGULATOR ADJUSTMENT

1. Adjusting Vss
   a. Switch S5 to RJD mode. Remove type linearizer PCB.
   b. Put the instrument in °C mode.
   c. Using an oscilloscope, observe the Strobe 0 signal on pin 9 of U4 with respect to digital common.
   d. Using a DMM, measure between digital common and pin 1 of U4.
   e. Adjust Vss (R4) on the oscillator regulator for maximum (around 8V). If the Strobe 0 pulse width in step 3 is not 320 μs and stable, then decrease Vss until the Strobe 0 pulse width is 320 μs and stable.
   f. Observing the DMM reading, continue to decrease Vss 200 mV below the point reached in step 4. (For example, if Vss in step 4 is 7.65V, reduce to 7.45V).
   g. Check that the display is flashing -200. If the display is not flashing -200, decrease Vss until -200 is displayed. Decrease Vss another 200 mV.
   h. Put the instrument in °F mode. The display should be flashing -328. (There exists a range of Vss which will allow both °F and °C to display as described).
   i. Switch S5 to OPR mode. Reinstall type linearizer PCB.

2. Adjusting Clock Duty Cycle
   a. Observe the clock at pin 2 of the LSI with a 13 pf (X10) scope probe.
   b. Adjust the Oscillator Regulator capacitor, C4, for the maximum amplitude clock that can be obtained and note the peak-to-peak value.

c. Adjust the Oscillator Regulator capacitor, C4, for the minimum amplitude clock that can be obtained and note the peak-to-peak value.

d. Set the Oscillator Regulator capacitor, C4, so that the peak-to-peak amplitude is .2 less than midway between the values in b. and c.

217XA OSCILLATOR REGULATOR ADJUSTMENT

1. Adjusting Vss

   a. Switch S5 to RJD mode. Remove type linearizer PCB.

   b. Put the instrument in °F mode.

   c. Using an oscilloscope, observe the Strobe 0 signal on pin 9 of U4 with respect to digital common.

   d. Using a DMM, measure between digital common and pin 1 of U4.

   e. Adjust Vss (R4) on the oscillator regulator for maximum (around 8V). If the Strobe 0 pulse width in step 3 is not 320 μs and stable, then decrease Vss until the Strobe 0 pulse width is 320 μs and stable.

   f. Observing the DMM reading, continue to decrease Vss 200 mV below the point reached in step 4. (For example, if Vss in step 4 is 7.65V, reduce to 7.45V).

   g. Put the instrument in °C mode. With the thermocouple circuit open, the display should be flashing -99.9.

   h. Switch S5 to OPR mode. Reinstall type linearizer PCB.

2. Adjusting Clock Duty Cycle

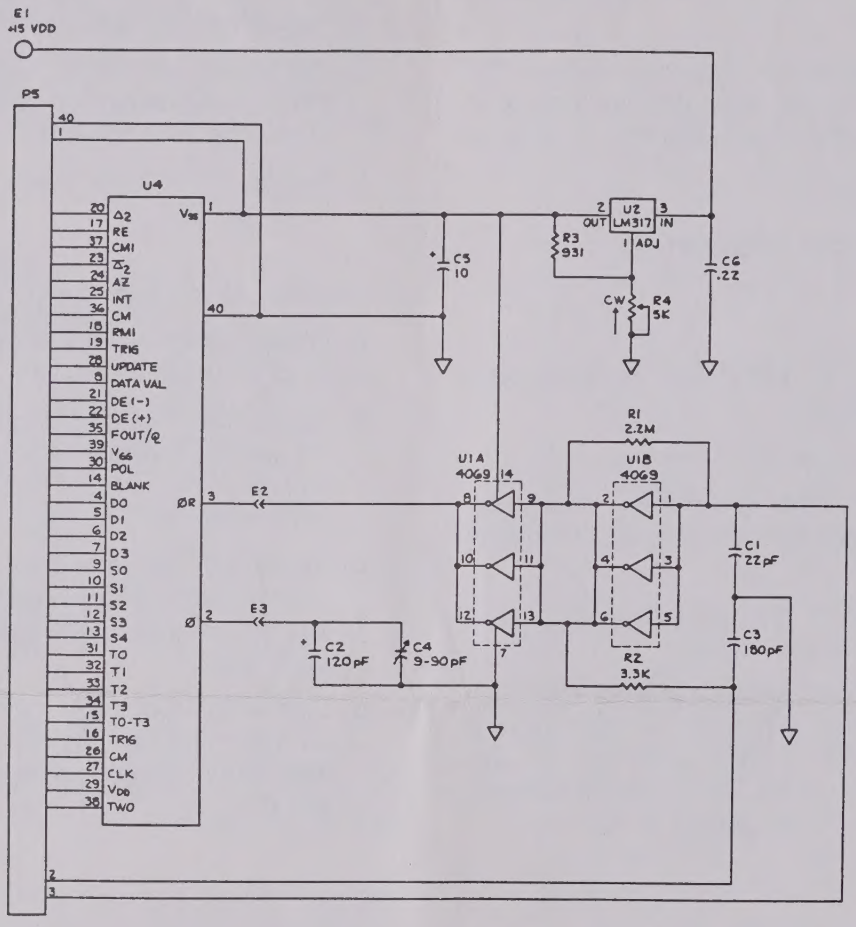
   a. Observe the clock at pin 2 of the LSI with a 13 pf (X10) scope probe.

   b. Adjust the Oscillator Regulator capacitor, C4, for the maximum amplitude clock that can be obtained and note the peak-to-peak value.

   c. Adjust the Oscillator Regulator capacitor, C4, for the minimum amplitude clock that can be obtained and note the peak-to-peak value.

   d. Set the Oscillator Regulator capacitor, C4, so that the peak-to-peak amplitude is .2 less than midway between the values in b. and c.

Add the following schematic of the LSI Assembly to your Instruction Manual.



Oscillator Regulator 2160A-1022

PERFORMANCE TEST CHECKLIST

Fluke Model 2175A Digital Thermometer

Serial Number _____
Tested By: _____
Date: _____

°F VERIFICATION TABLE (Temperature Accuracy)

PROBE TYPE	NOMINAL TEMPERATURE °F	90 DAY			1 YEAR		
		MIN.	ACTUAL	MAX.	MIN.	ACTUAL	MAX.
J	992	990.6		993.4	990.2		993.8
	112	110.6		113.4	110.2		113.8
	–28	–29.8		–26.2	–30.3		–25.7
	–88	–89.8		–86.2	–90.3		–85.7
K	992	990.4		993.6	990		994
	152	150.4		153.6	150		154
	–48	–50.2		–45.8	–50.8		–45.2
	–88	–90.2		–85.8	–90.8		–85.2
T	732	730.8		733.2	730.3		733.7
	72	70.8		73.2	70.3		73.7
	–28	–29.9		–26.1	–31.1		–24.9
	–88	–89.9		–86.1	–91.1		–84.9
E	992	990.5		993.5	990		994
	112	110.5		113.5	110		114
	–28	–29.9		–26.1	–31.2		–24.8
	–88	–89.9		–86.1	–91.2		–84.8

Line Voltage Regulation _____ Passed ( ) Failed ( )
Accuracy Test _____ See Verification Tables

°F VERIFICATION TABLE (Reference-Junction Accuracy)

PROBE TYPE	90-Day or 1-Year	
	Deviation Error From Room-Temperature Lag Bath	
	Maximum	Actual
J	±1.5°	
K	±2.0°	
T	±1.5°	
E	±1.5°	

PERFORMANCE TEST CHECKLIST, Cont.

°C VERIFICATION TABLE (Temperature Accuracy)

PROBE TYPE	NOMINAL TEMPERATURE °C	90 DAY			1 YEAR		
		MIN.	ACTUAL	MAX.	MIN.	ACTUAL	MAX.
J	755.6	754.8	_____	756.4	754.4	_____	756.8
	44.4	43.6	_____	45.2	43.2	_____	45.6
	–44.4	–45.5	_____	–43.3	–45.7	_____	–43.1
	–77.8	–78.9	_____	–76.7	–79.1	_____	–76.5
K	977.8	976.6	_____	979	976.3	_____	979.3
	22.2	21	_____	23.4	20.7	_____	23.7
	–44.4	–45.7	_____	–43.1	–46	_____	–42.8
	–77.8	–79.1	_____	–76.5	–79.4	_____	–76.2
T	377.8	377.1	_____	378.5	376.8	_____	378.8
	22.2	21.5	_____	22.9	21.2	_____	23.2
	–55.6	–56.7	_____	–54.5	–57.3	_____	–53.9
	–77.8	–78.9	_____	–76.7	–79.5	_____	–76.7
E	977.8	976.7	_____	978.9	976.3	_____	979.3
	44.4	43.3	_____	45.5	42.9	_____	45.9
	–55.6	–56.7	_____	–54.5	–57.4	_____	–53.8
	–77.8	–78.9	_____	–76.7	–79.6	_____	–76.0

Overload

Overrange . . . . . Passed ( ) Failed ( )

Open Circuit . . . . . Passed ( ) Failed ( )

Internal Temperature Rise . . . . . <8.0°C (14.4°F) above ambient

°C VERIFICATION TABLE (Reference-Junction Accuracy)

PROBE TYPE	90-Day or 1-Year Deviation Error From Room-Temperature Lag Bath	
	Maximum	Actual
J	±1.5°	
K	±1.5°	
T	±1.5°	
E	±1.5°	